FlexControl 14

User's manual

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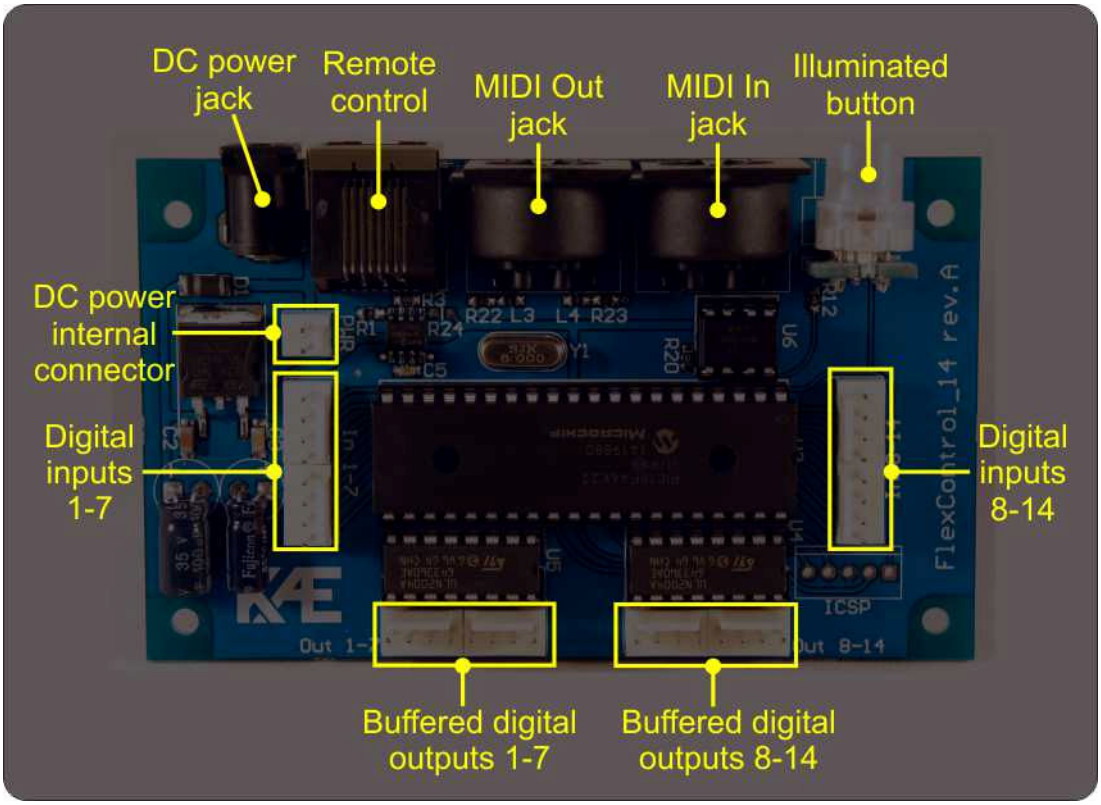
www.kae-systems.com

What's this?

'FlexControl 14' is a universal multi-purpose MIDI device. It provides 14 digital buffered outputs, controllable simultaneously by: 14 on-board digital inputs, MIDI messages or another 'FlexControl 14' device.

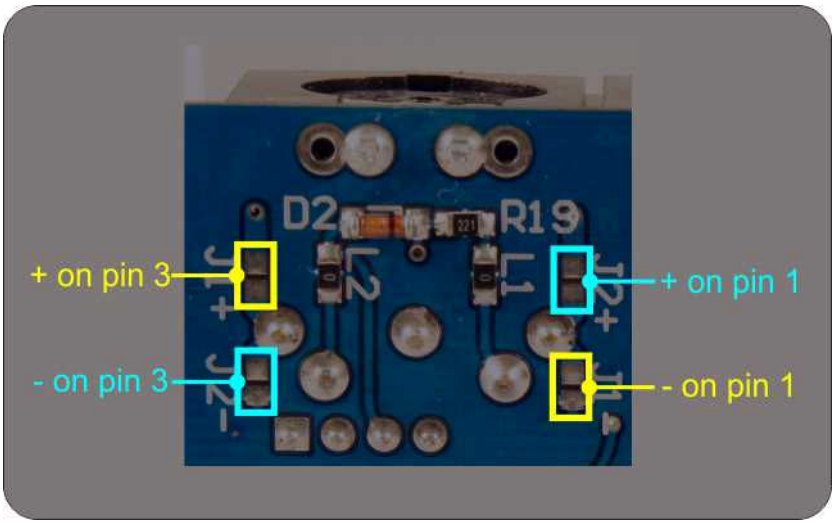
Hardware features (board revision A)



- 14 high-current open-collector digital outputs for relays / LEDs / servo motors
- 14 digital inputs (pulled up) for buttons or switches
- All digital inputs and outputs go out on standard 2,54mm male connectors
- 1 'MIDI In' DIN5 connector
- 1 'MIDI Out/Thru' DIN5 connector
- Semi-transparent illuminated button for MIDI presets programming
- RJ-45 jack for connecting another 'FlexControl 14' remote control board over straight-through Ethernet cable.
- Phantom power with configurable polarity available on pins 1 and 3 of the 'MIDI In' jack
- 2.5mm DC power jack (with center positive pin).
- 2-pin DC power connector
- Reverse polarity protection
- Specially designed for panel mounting
- Non-volatile memory to store user configuration and presets

Supplying phantom power to pins 1 and 3 of the *MIDI In* jack

Some MIDI devices can be powered through spare pins **1** and **3** of their MIDI Out jacks. 'FlexControl 14' is ready to complement this feature by providing 4 jumper pads on its bottom side. Depending on the device you want to power, you'll need to shorten jumpers **J1+** and **J1-** or **J2+** and **J2-**, as shown on the picture below:



Please note: Do not shorten any of J**1**x and J**2**x jumpers simultaneously! That will short circuit your power supply and almost certainly will damage it; 'FlexControl 14' will be certainly damaged too!

How it works?

'FlexControl 14' comes with 3 pre-programmed firmware profiles (applications), which can be activated and configured by special Windows® application 'FlexControl configurator'.

All firmware profiles share some common features like:

- Configurable activation edges on digital inputs. The choice is between *falling* and both *falling and rising* edges. This allows both retentive and non-retentive switches to be attached to the inputs.
- Individually configurable role of each output (PWM or simple digital)
- Individually configurable period and duty cycle for each PWM output
- All received MIDI messages are being output immediately on *MIDI Out*

Following features are available for all profiles, except for 'Remote':

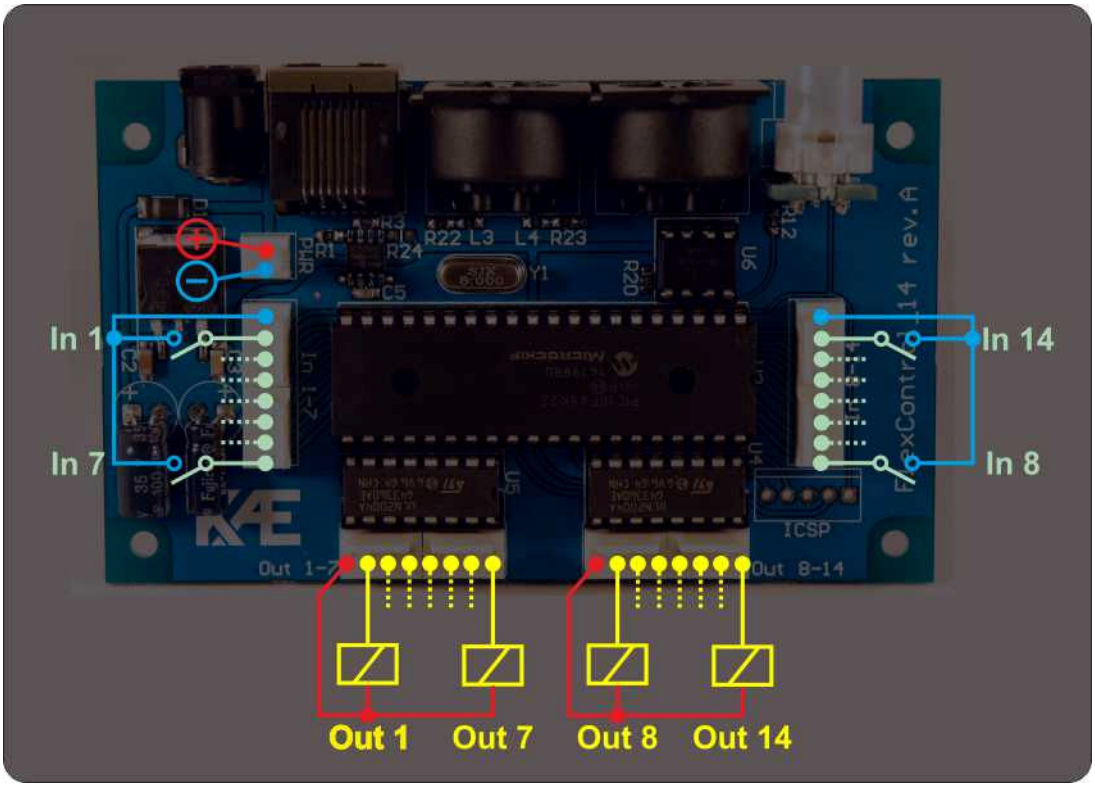
- Configurable polarity of the outputs (normally 'off' or normally 'on'), also applicable for PWM outputs.
- Configurable mutual exclusive outputs (i.e. "mutex"). In a mutex group, there can be only one active output. There can be mutex and non-mutex outputs working in parallel.
- Configurable delay at startup
- Configurable reception MIDI channel (1-16 or all)
- Configurable MIDI controller for relay output #1. The rest of the outputs have consecutive increasing numbers.
- Configurable MIDI presets.

Each profile requires specific hardware wiring.

Profile “Amp control”

Designed to control guitar/bass amplifiers.

Wiring diagram



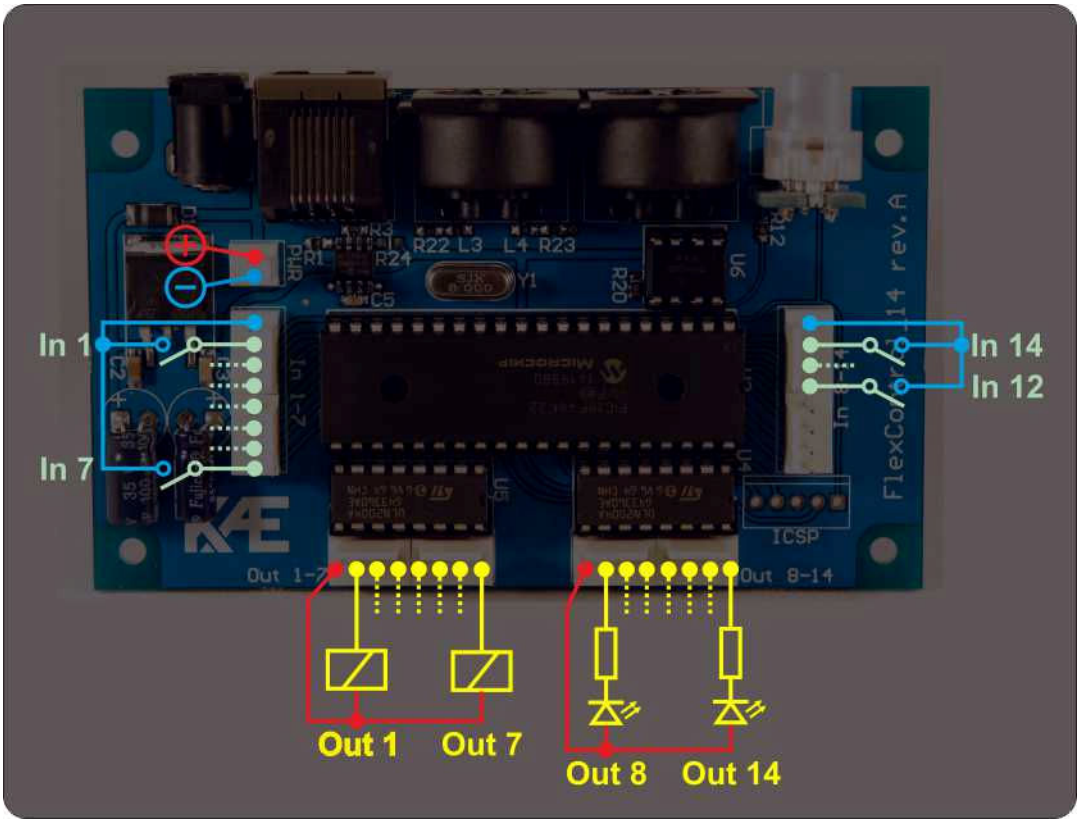
Firmware operation

- Each input can control only an output with the same number (In 1 -> Out 1; In 2 -> Out 2 and etc.).
- All the 14 outputs have latching action (see below for the exception).
- One of the outputs can be assigned (optionally) to act as a pulse output, which is activated simultaneously with any other output.
- Every output (except the pulse one) can be switched on and off individually by a MIDI ‘Control change’ message.
- Some (or all) outputs can be configured in mutual exclusive group (“mutex”). In addition, the state of all non-mutex outputs can be memorized and subsequently restored on activation of a mutex output.
- Non-mutex outputs toggle on each activation.
- All outputs (except the pulse one) can be switched at once by a MIDI ‘Program change’ message.
- A MIDI preset can be programmed by starting a MIDI preset programming sequence.

Profile “Looper”

Designed to control effect switching systems (a.k.a “loopers”) for musicians. The idea is the musician to switch numerous effect pedals at once with a single button/switch.

Wiring diagram



Firmware operation

The user has 14 inputs, 14 relay outputs and 14 indication outputs. The relay outputs control the effect pedals (on/off), while indication outputs show additional information depending on the work mode. The relay outputs can be loaded at once by a ‘preset’. There are 14 local and 128 MIDI presets. Those preset groups are independent from each other and are stored in separate non-volatile memory locations. The local presets can be recalled only by the digital inputs, while the MIDI presets can be recalled only by MIDI ‘Program change’ messages.

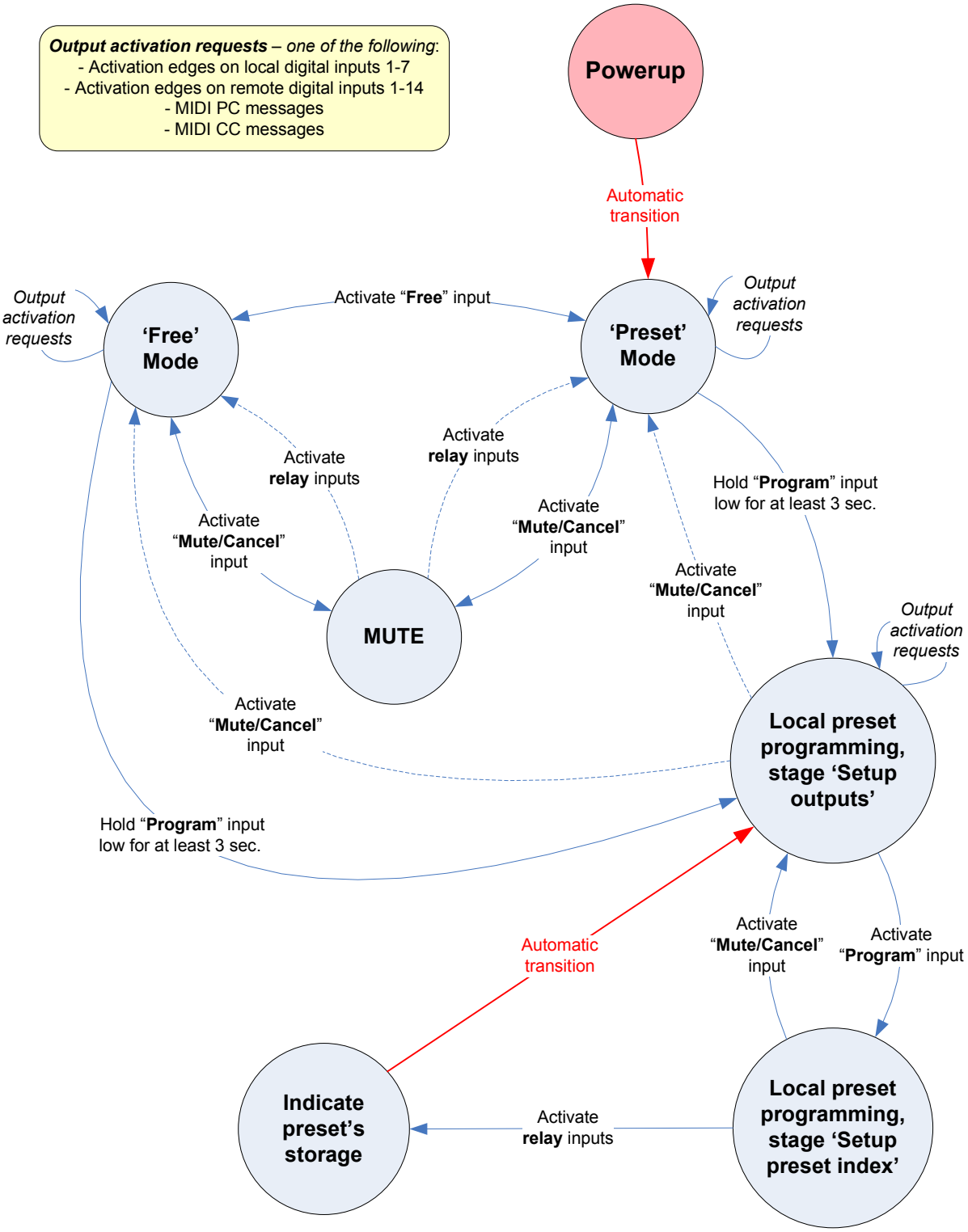
There are 3 modes of operation:

- ‘Preset’ – the user loads pre-programmed local presets into relay outputs.
- ‘Free’ – relay outputs can be freely turned on or off
- ‘Local preset programming’ – the user can define the local presets that’ll be used in ‘Preset’ mode.

One ‘FlexControl 14’ board can output only first 7 relay outputs and first 7 indication outputs; the upper outputs are supplied by another ‘FlexControl 14’ board, working with profile ‘Remote’.

A MIDI preset can be programmed by starting a MIDI preset programming sequence, but only from modes ‘Preset’ or ‘Free’.

States and transitions diagram


Output activation requests *– one of the following*:
- Activation edges on local digital inputs 1-7
- Activation edges on remote digital inputs 1-14
- MIDI PC messages
- MIDI CC messages
Powerup
Automatic transition
'Free' Mode
'Preset' Mode
Output activation requests
Activate "**Free**" input
Activate **relay** inputs
Activate "**Mute/Cancel**" input
MUTE
Hold "**Program**" input low for at least 3 sec.
Local preset programming, stage 'Setup outputs'
Hold "**Program**" input low for at least 3 sec.
Indicate preset's storage
Local preset programming, stage 'Setup preset index'
Activate "**Program**" input

Action table

Stimulus source	Stimulus type	Work mode	Action
Relay inputs	Activation edge	Preset	Input 1 loads preset #1, Input 2 loads preset #2 etc. Relay outputs show the currently active local preset. Indication outputs show the index of currently active local preset.
		Free	Relay outputs: - Mutex outputs: requested output is on, others - off - Non-mutex outputs: toggle Indication outputs: all off
		Local preset programming, stage 'Setup outputs'	Relay outputs: - Mutex outputs: requested output is on, others - off - Non-mutex outputs: toggle Indication outputs: all on
Local input 12 'Local programming'	Active level (Hold for at least 3 seconds to enter 'Local preset programming' mode)	Preset Free	Enter stage 'Setup outputs' Indication outputs: all on.
	Activation edge	Local preset programming, stage 'Setup outputs'	Go to stage 'Setup preset index' Indication outputs starts to toggle with fast rate.
		Local preset programming, stage 'Setup preset index'	The indication outputs show the index of currently programmed preset with 3-time blink. Go back to stage 'Setup outputs'
Local input 13 'Free'	Activation edge	Preset	Go to "Free" mode
		Free	Go to "Normal" mode.
		All other	No effect.
Local input 14 'Mute/Cancel'	Activation edge	Preset Free	Turn all relay outputs off immediately
		Local preset programming	If in stage "Setup outputs": return to normal or free mode If in stage "Setup preset number": return to stage "Setup outputs"
		Mute	Restore the previous state of relay outputs
MIDI Program change message	-	Preset Free	Load a MIDI preset to relay outputs
MIDI Controller change message	value > 63	Preset Free Local preset programming	Only relay outputs: turn on specific channel
	value < 64		Only relay non-mutex outputs: turn off specific channel

Profile “Remote”

Designed as slave extension or remote control when working together with another master ‘FlexControl 14’ board. Both master and slave boards should be connected with a straight-through Ethernet cable (same pinout on both ends). The profile doesn’t react on MIDI PC and CC messages.

When used with master ‘Amp control’ board, it acts only as remote control:
- ‘Remote’ inputs and ‘Amp control’ inputs work in parallel.
- ‘Remote’ outputs copy the state of ‘Amp control’ outputs.

When used with master ‘Looper’ board, there are 2 scenarios:

- The ‘Looper’ interprets ‘Remote’ as remote control.

‘Remote’ device provide all 14 inputs. ‘Remote’s inputs 1-7 and ‘Amp control’s inputs 1-7 work in parallel.
All ‘Remote’s outputs copy the state of ‘Looper’s outputs.

- The ‘Looper’ interprets ‘Remote’ as extension.

In this case ‘Remote’s outputs 1-7 will output relay outputs 8-14, and ‘Remote’s outputs 8-14 will output indication outputs 8-14.

Wiring diagram

The wiring is the same as the wiring of the master board, except of the power jack and internal power pins.

Important: The ‘Remote’ board should be powered **only from the master board through the Ethernet cable**! Don’t connect any power supply to the remote board - neither to the DC power jack nor the internal DC power connector!

MIDI preset programming sequence

(Only for firmware profiles ‘Amp Control’ and ‘Looper’)

1. Power the device on.
2. Connect your MIDI controller’s MIDI output to the ‘FlexControl’s ‘MIDI In’ jack.
3. Press and hold the illuminated button until it starts to blink with a short pulse.
4. Configure the outputs you want in a preset (by on-board digital inputs / remote / MIDI CC message)
5. Send a **MIDI PC** message from your MIDI controller. The illuminated button will start to blink rapidly.
6. Press the button shortly to confirm the preset. It will light on for a while and after that will revert automatically to short pulse blinking.
7. Repeat steps 4 to 6 if necessary
8. To exit the programming sequence, press and hold the illuminated button until it light off or leave the board idle for 100 seconds.

‘FlexControl configurator’ utility

All important parameters of the firmware profiles can be configured only with few mouse clicks with the help of ‘FlexControl configurator’. It’s a small .NET GUI application for Microsoft® Windows OS. Visit www.kae-systems.com for the latest version.

Following prerequisites should be fulfilled to run the application:

- Your OS version should be at least ‘Windows XP SP3’
- .NET 4.0 or .NET 4.5 framework installed on your computer. Installation requires administrator privileges.
- A sound card with MIDI port or USB-MIDI cable connected to your computer.

Connect the *MIDI Out* jack of your device to the *MIDI In* jack of ‘FlexControl 14’ board and launch the application.

First, you should select the active firmware profile, by clicking menu ‘Firmware profile’. Then adjust the rest of parameters you need.

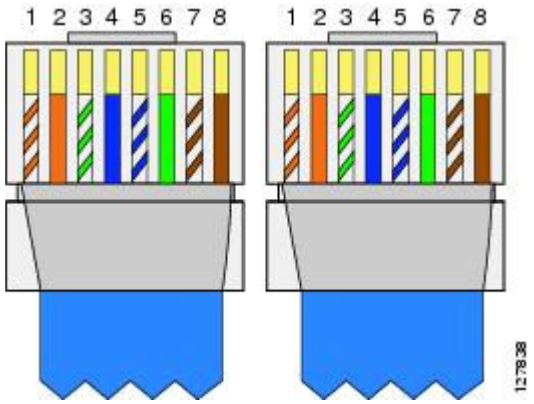
You can save the configuration you’ve made to a file.

Finally, hit the button ‘Write to device’ and wait for transfer to complete. **The new configuration will take effect at next power up**.

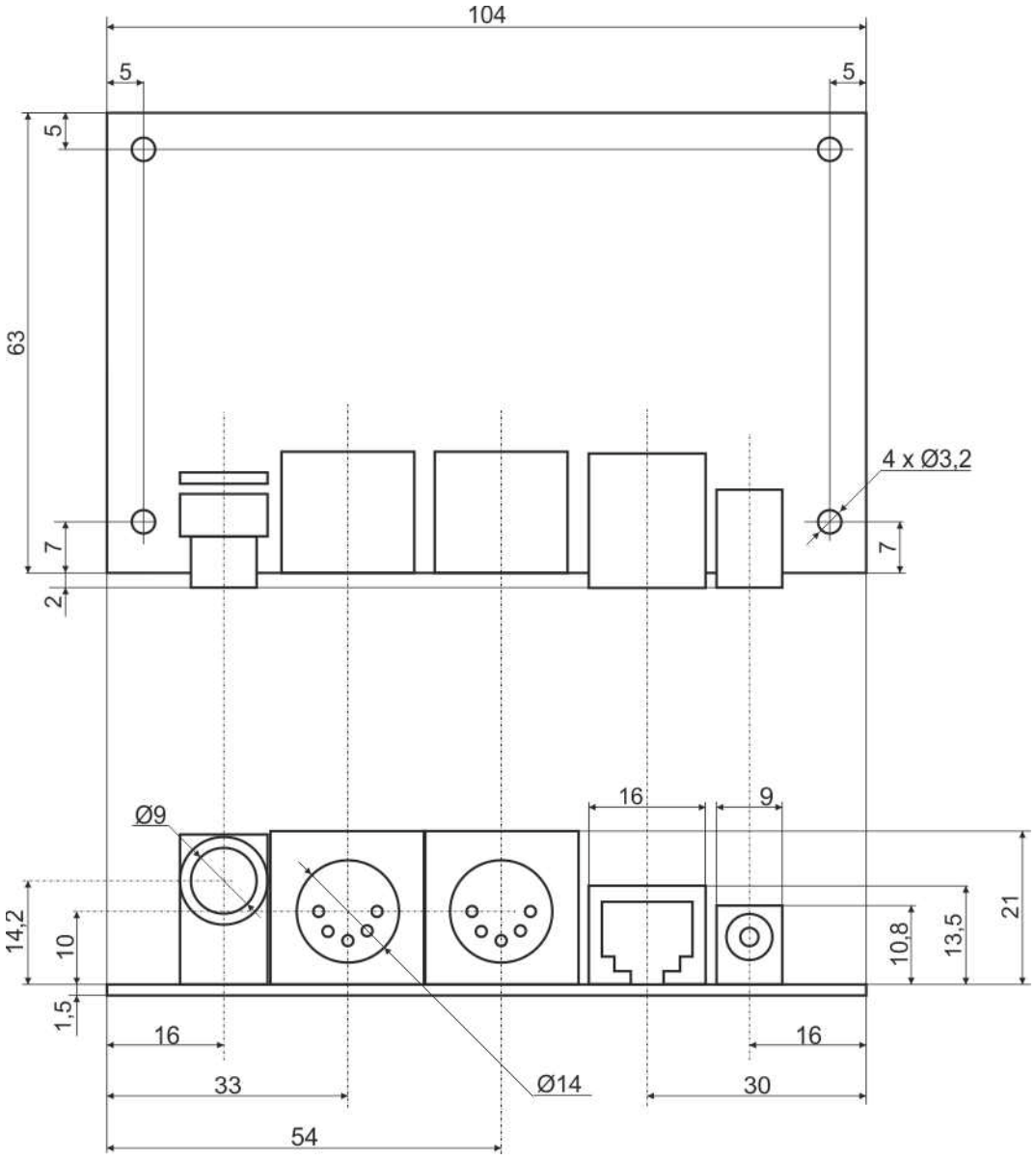
Electrical specifications

- Supply voltage range: 7,5 – 25V, recommended 9 - 15V.
- Power consumption: 20 mA @ 12V; no loads connected; all outputs off; LED off.

Straight-through Ethernet cable pinout



Mechanical drawing



All dimensions in millimeters.